

$I(J^P) = 0(0^-)$

$I, J, P$  need confirmation. Quantum numbers shown are quark-model predictions.

## $B_s^0$ MASS

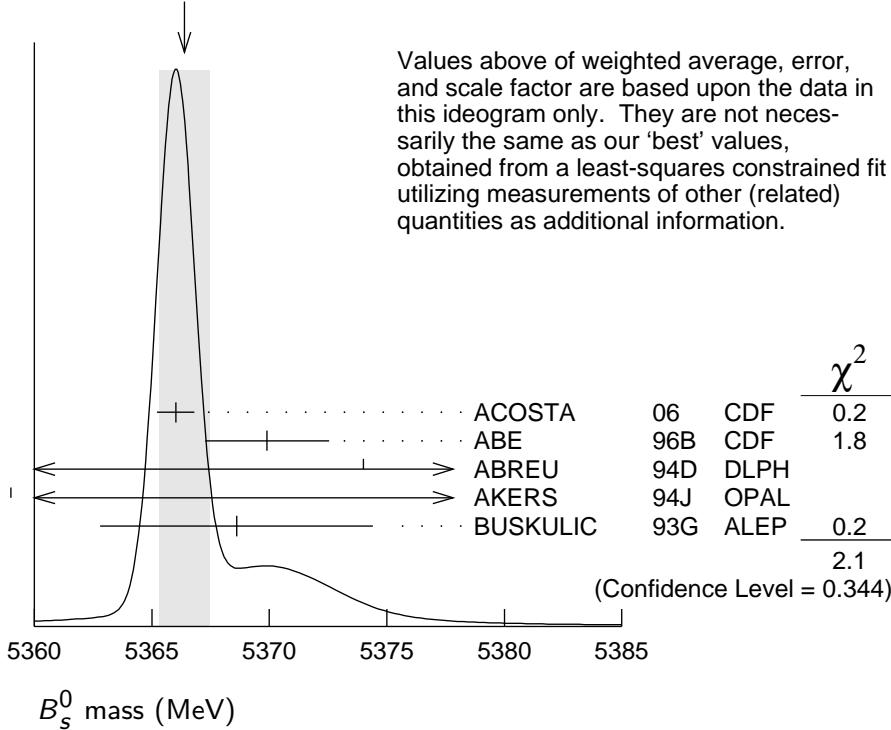
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>5366.1 ± 0.6 OUR FIT</b>				
<b>5366.4 ± 1.1 OUR AVERAGE</b>				Error includes scale factor of 1.4. See the ideogram below.
5366.01 ± 0.73 ± 0.33		1 ACOSTA	06 CDF	$p\bar{p}$ at 1.96 TeV
5369.9 ± 2.3 ± 1.3	32	2 ABE	96B CDF	$p\bar{p}$ at 1.8 TeV
5374 ± 16 ± 2	3	ABREU	94D DLPH	$e^+e^- \rightarrow Z$
5359 ± 19 ± 7	1	2 AKERS	94J OPAL	$e^+e^- \rightarrow Z$
5368.6 ± 5.6 ± 1.5	2	BUSKULIC	93G ALEP	$e^+e^- \rightarrow Z$
<b>• • • We do not use the following data for averages, fits, limits, etc. • • •</b>				
5370 ± 40	6	3 AKERS	94J OPAL	$e^+e^- \rightarrow Z$
5383.3 ± 4.5 ± 5.0	14	ABE	93F CDF	Repl by ABE 96B

<sup>1</sup> Uses exclusively reconstructed final states containing a  $J/\psi \rightarrow \mu^+\mu^-$  decays.

<sup>2</sup> From the decay  $B_s \rightarrow J/\psi(1S)\phi$ .

<sup>3</sup> From the decay  $B_s \rightarrow D_s^-\pi^+$ .

WEIGHTED AVERAGE  
5366.4±1.1 (Error scaled by 1.4)



### $m_{B_s^0} - m_B$

$m_B$  is the average of our  $B$  masses ( $m_{B^\pm} + m_{B^0})/2$ .

VALUE (MeV)	CL%	DOCUMENT ID	TECN	COMMENT
<b>86.8 ± 0.6 OUR FIT</b>				
<b>86.9 ± 0.8 OUR AVERAGE</b>				
86.64 ± 0.80 ± 0.08		<sup>4</sup> ACOSTA 06	CDF	$p\bar{p}$ at 1.96 TeV
89.7 ± 2.7 ± 1.2		ABE 96B	CDF	$p\bar{p}$ at 1.8 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
80 to 130	68	LEE-FRANZINI 90	CSB2	$e^+ e^- \rightarrow \gamma(5S)$
<sup>4</sup> The reported result is $m_{B_s^0} - m_{B^0} = 86.38 \pm 0.90 \pm 0.06$ MeV. We convert it to the mass difference with respect to the average of ( $m_{B^\pm} + m_{B^0})/2$ .				

### $m_{B_{sH}^0} - m_{B_{sL}^0}$

See the  $B_s^0$ - $\overline{B}_s^0$  MIXING section near the end of these  $B_s^0$  Listings.

### $B_s^0$ MEAN LIFE

"OUR EVALUATION" is an average using rescaled values of the data listed below. The average and rescaling were performed by the Heavy Flavor Averaging Group (HFAG) and are described at <http://www.slac.stanford.edu/xorg/hfag/>. The averaging/rescaling procedure takes into account correlations between the measurements and asymmetric lifetime errors.

The First "OUR EVALUATION" is an average of  $1 / [0.5 (\Gamma_{B_{SL}^0} + \Gamma_{B_{SL}^0})]$ . The Second "OUR EVALUATION" is the average of  $B_s \rightarrow D_s X$  lifetimes.

VALUE ( $10^{-12}$ s)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>1.437<sup>+0.031</sup><sub>-0.030</sub> OUR EVALUATION</b>	First			
<b>1.425±0.041 OUR EVALUATION</b>	Second			
1.398 ± 0.044 <sup>+0.028</sup> <sub>-0.025</sub>	5	ABAZOV 06V	D0	$p\bar{p}$ at 1.96 TeV
1.42 ± 0.14 ± 0.03	6	ABREU 00Y	DLPH	$e^+ e^- \rightarrow Z$
1.53 ± 0.16 ± 0.07	7	ABREU,P 00G	DLPH	$e^+ e^- \rightarrow Z$
1.36 ± 0.09 ± 0.06	8	ABE 99D	CDF	$p\bar{p}$ at 1.8 TeV
1.72 ± 0.20 ± 0.18	9	ACKERSTAFF 98F	OPAL	$e^+ e^- \rightarrow Z$
1.50 ± 0.16 ± 0.04	8	ACKERSTAFF 98G	OPAL	$e^+ e^- \rightarrow Z$
1.47 ± 0.14 ± 0.08	7	BARATE 98C	ALEP	$e^+ e^- \rightarrow Z$
1.54 ± 0.14 ± 0.04	8	BUSKULIC 96M	ALEP	$e^+ e^- \rightarrow Z$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.51 $\pm 0.11$	<sup>10</sup> BARATE	98C ALEP	$e^+ e^- \rightarrow Z$
1.56 $^{+0.29}_{-0.26}$ $^{+0.08}_{-0.07}$	<sup>8</sup> ABREU	96F DLPH	Repl. by ABREU 00Y
1.65 $^{+0.34}_{-0.31}$ $\pm 0.12$	<sup>7</sup> ABREU	96F DLPH	Repl. by ABREU 00Y
1.76 $\pm 0.20$ $^{+0.15}_{-0.10}$	<sup>11</sup> ABREU	96F DLPH	Repl. by ABREU 00Y
1.60 $\pm 0.26$ $^{+0.13}_{-0.15}$	<sup>12</sup> ABREU	96F DLPH	Repl. by ABREU,P 00G
1.67 $\pm 0.14$	<sup>13</sup> ABREU	96F DLPH	$e^+ e^- \rightarrow Z$
1.61 $^{+0.30}_{-0.29}$ $^{+0.18}_{-0.16}$	90	<sup>7</sup> BUSKULIC	96E ALEP
1.42 $^{+0.27}_{-0.23}$ $\pm 0.11$	76	<sup>8</sup> ABE	95R CDF
1.74 $^{+1.08}_{-0.69}$ $\pm 0.07$	8	<sup>14</sup> ABE	95R CDF
1.54 $^{+0.25}_{-0.21}$ $\pm 0.06$	79	<sup>8</sup> AKERS	95G OPAL
1.59 $^{+0.17}_{-0.15}$ $\pm 0.03$	134	<sup>8</sup> BUSKULIC	95O ALEP
0.96 $\pm 0.37$	41	<sup>15</sup> ABREU	94E DLPH
1.92 $^{+0.45}_{-0.35}$ $\pm 0.04$	31	<sup>8</sup> BUSKULIC	94C ALEP
1.13 $^{+0.35}_{-0.26}$ $\pm 0.09$	22	<sup>8</sup> ACTON	93H OPAL

<sup>5</sup> Measured using  $D_s \mu^+$  vertices.

<sup>6</sup> Uses  $D_s^- \ell^+$ , and  $\phi \ell^+$  vertices.

<sup>7</sup> Measured using  $D_s$  hadron vertices.

<sup>8</sup> Measured using  $D_s^- \ell^+$  vertices.

<sup>9</sup> ACKERSTAFF 98F use fully reconstructed  $D_s^- \rightarrow \phi \pi^-$  and  $D_s^- \rightarrow K^{*0} K^-$  in the inclusive  $B_s^0$  decay.

<sup>10</sup> Combined results from  $D_s^- \ell^+$  and  $D_s$  hadron.

<sup>11</sup> Measured using  $\phi \ell$  vertices.

<sup>12</sup> Measured using inclusive  $D_s$  vertices.

<sup>13</sup> Combined result for the four ABREU 96F methods.

<sup>14</sup> Exclusive reconstruction of  $B_s \rightarrow \psi \phi$ .

<sup>15</sup> ABREU 94E uses the flight-distance distribution of  $D_s$  vertices,  $\phi$ -lepton vertices, and  $D_s \mu$  vertices.

## $B_s^0$ MEAN LIFE (Flavor specific)

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>1.417 \pm 0.042</math> OUR EVALUATION</b>			
<b><math>1.41 \pm 0.04</math> OUR AVERAGE</b>			
1.398 $\pm 0.044$ $^{+0.028}_{-0.025}$	<sup>16</sup> ABAZOV	06V D0	$p\bar{p}$ at 1.96 TeV
1.42 $^{+0.14}_{-0.13}$ $\pm 0.03$	<sup>17</sup> ABREU	00Y DLPH	$e^+ e^- \rightarrow Z$
1.36 $\pm 0.09$ $^{+0.06}_{-0.05}$	<sup>18</sup> ABE	99D CDF	$p\bar{p}$ at 1.8 TeV
1.50 $^{+0.16}_{-0.15}$ $\pm 0.04$	<sup>19</sup> ACKERSTAFF	98G OPAL	$e^+ e^- \rightarrow Z$
1.54 $^{+0.14}_{-0.13}$ $\pm 0.04$	<sup>18</sup> BUSKULIC	96M ALEP	$e^+ e^- \rightarrow Z$

16 Measured using  $D_s^- \mu^+$  vertices.

17 Uses  $D_s^- \ell^+$ , and  $\phi \ell^+$  vertices.

18 Measured using  $D_s^- \ell^+$  vertices.

19 ACKERSTAFF 98F use fully reconstructed  $D_s^- \rightarrow \phi \pi^-$  and  $D_s^- \rightarrow K^{*0} K^-$  in the inclusive  $B_s^0$  decay.

## $B_s^0$ MEAN LIFE ( $B_s \rightarrow J/\psi \phi$ )

VALUE	DOCUMENT ID	TECN	COMMENT
<b>1.429 ± 0.088 OUR EVALUATION</b>			

### **1.42 $^{+0.08}_{-0.07}$ OUR AVERAGE**

1.444  $^{+0.098}_{-0.090}$   $\pm 0.020$  20 ABAZOV 05B D0  $p\bar{p}$  at 1.96 TeV

1.40  $^{+0.15}_{-0.13}$   $\pm 0.02$  21 ACOSTA 05 CDF  $p\bar{p}$  at 1.96 TeV

1.34  $^{+0.23}_{-0.19}$   $\pm 0.05$  20 ABE 98B CDF  $p\bar{p}$  at 1.8 TeV

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.39  $^{+0.13}_{-0.16}$   $^{+0.01}_{-0.02}$  21 ABAZOV 05W D0  $p\bar{p}$  at 1.96 TeV

1.34  $^{+0.23}_{-0.19}$   $\pm 0.05$  22 ABE 96N CDF Repl. by ABE 98B

20 Measured using fully reconstructed  $B_s \rightarrow J/\psi(1S)\phi$  decay.

21 Measured using the time-dependent angular analysis of  $B_s^0 \rightarrow J/\psi \phi$  decays.

22 ABE 96N uses  $58 \pm 12$  exclusive  $B_s \rightarrow J/\psi(1S)\phi$  events.

## $\tau_{B_s^0}/\tau_{B^0}$ MEAN LIFE RATIO

### $\tau_{B_s^0}/\tau_{B^0}$ (direct measurements)

VALUE	DOCUMENT ID	TECN	COMMENT
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0.91  $\pm 0.09$   $\pm 0.003$  23 ABAZOV 05W D0  $p\bar{p}$  at 1.96 TeV

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.980  $^{+0.076}_{-0.071}$   $\pm 0.003$  24 ABAZOV 05B D0 Repl. by ABAZOV 05W

23 Measured using the time-dependent angular analysis of  $B_s^0 \rightarrow J/\psi \phi$  decays.

24 Measured mean life ratio using fully reconstructed decays.

## $B_{sH}^0$ MEAN LIFE

$B_{sH}^0$  is the heavy mass state of two  $B_s^0$  CP eigenstates.

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<i>VALUE</i> ( $10^{-12}$ s)	<i>DOCUMENT ID</i>	<i>TECN</i>	<i>COMMENT</i>
<b>1.530<sup>+0.077</sup><sub>-0.083</sub> OUR EVALUATION</b>			
<b>1.78 ± 0.32 OUR AVERAGE</b>			
1.58 $+0.39$ $+0.01$ $-0.42$ $-0.02$	25 ABAZOV	05W D0	$p\bar{p}$ at 1.96 TeV
2.07 $+0.58$ $\pm 0.03$ $-0.46$	25 ACOSTA	05 CDF	$p\bar{p}$ at 1.96 TeV
25 Measured using the time-dependent angular analysis of $B_s^0 \rightarrow J/\psi \phi$ decays.			

### $B_{sL}^0$ MEAN LIFE

$B_{sL}^0$  is the light state of two  $B_s^0$  CP eigenstates.

“OUR EVALUATION” is an average using rescaled values of the data listed below. The average and rescaling were performed by the Heavy Flavor Averaging Group (HFAG) and are described at <http://www.slac.stanford.edu/xorg/hfag/>. The averaging/rescaling procedure takes into account correlations between the measurements.

<i>VALUE</i> ( $10^{-12}$ s)	<i>DOCUMENT ID</i>	<i>TECN</i>	<i>COMMENT</i>
<b>1.355<sup>+0.063</sup><sub>-0.059</sub> OUR EVALUATION</b>			
<b>1.18<sup>+0.10</sup><sub>-0.08</sub> OUR AVERAGE</b>			
1.24 $+0.14$ $+0.01$ $-0.11$ $-0.02$	26 ABAZOV	05W D0	$p\bar{p}$ at 1.96 TeV
1.05 $+0.16$ $\pm 0.02$ $-0.13$	26 ACOSTA	05 CDF	$p\bar{p}$ at 1.96 TeV
1.27 $\pm 0.33$ $\pm 0.08$	27 BARATE	00K ALEP	$e^+ e^- \rightarrow Z$
26 Measured using the time-dependent angular analysis of $B_s^0 \rightarrow J/\psi \phi$ decays.			
27 Uses $\phi\phi$ correlations from $B_s^0 \rightarrow D_s^{(*)+} D_s^{(*)-}$ .			

### $\Delta\Gamma_{B_s^0}/\Gamma_{B_s^0}$

$\Gamma_{B_s^0}$  and  $\Delta\Gamma_{B_s^0}$  are the decay rate average and difference between two  $B_s^0$  CP eigenstates (light – heavy).

“OUR EVALUATION” is an average of all available  $B_s$  semi-leptonic lifetime measurements with the  $\Delta\Gamma_{B_s^0}/\Gamma_{B_s^0}$  analyses performed by the Heavy

Flavor Averaging Group (HFAG) as described in our “Review on  $B$ - $\overline{B}$  Mixing” in the  $B^0$  Section of these Listings. The corresponding 95% CL is  $-0.06 < \Delta\Gamma_{B_s^0}/\Gamma_{B_s^0} < 0.28$ .

<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>0.121</b> <b>+0.083</b> <b>-0.090</b>	<b>OUR EVALUATION</b>			
0.24	+0.28 -0.38	+0.03 -0.04	28,29 ABAZOV	05W D0 $p\bar{p}$ at 1.96 TeV
0.65	+0.25 -0.33	$\pm 0.01$	28 ACOSTA	05 CDF $p\bar{p}$ at 1.96 TeV
<0.46	95	30 ABREU	00Y DLPH $e^+ e^- \rightarrow Z$	
<0.69	95	31 ABREU,P	00G DLPH $e^+ e^- \rightarrow Z$	
0.25	+0.21 -0.14	32 BARATE	00K ALEP $e^+ e^- \rightarrow Z$	
<0.83	95	33 ABE	99D CDF $p\bar{p}$ at 1.8 TeV	
<0.67	95	34 ACCIARRI	98S L3 $e^+ e^- \rightarrow Z$	
28	Measured using the time-dependent angular analysis of $B_s^0 \rightarrow J/\psi \phi$ decays.			
29	Uses $ A_0 ^2 -  A_{  } ^2 = 0.355 \pm 0.066$ from ACOSTA 05.			
30	Uses $D_s^- \ell^+$ , and $\phi \ell^+$ vertices.			
31	Measured using $D_s$ hadron vertices.			
32	Uses $\phi \phi$ correlations from $B_s^0 \rightarrow D_s^{(*)+} D_s^{(*)-}$ .			
33	ABE 99D assumes $\tau_{B_s^0} = 1.55 \pm 0.05$ ps.			
34	ACCIARRI 98S assumes $\tau_{B_s^0} = 1.49 \pm 0.06$ ps and PDG 98 values of $b$ production fraction.			

 $\Delta\Gamma_{B_s^0}$ 

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<u>VALUE</u> ( $10^{12} \text{ s}^{-1}$ )	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
<b>0.084</b> <b>+0.055</b> <b>-0.050</b>	<b>OUR EVALUATION</b>			
<b>0.16</b> <b>+0.10</b> <b>-0.13</b>	<b>OUR AVERAGE</b>	Error includes scale factor of 1.4.		
0.12	+0.08 -0.10	$\pm 0.02$	35,36 ABAZOV    07 D0 $p\bar{p}$ at 1.96 TeV	
0.47	+0.19 -0.24	$\pm 0.01$	35 ACOSTA    05 CDF $p\bar{p}$ at 1.96 TeV	
35	Measured using the time-dependent angular analysis of $B_s^0 \rightarrow J/\psi \phi$ decays and assuming $CP$ -violating phase $\phi_s = 0$ .			
36	ABAZOV 07 reports $0.17 \pm 0.09 \pm 0.02$ with $CP$ -violating phase $\phi_s$ as a free parameter.			

## $B_s^0$ DECAY MODES

These branching fractions all scale with  $B(\bar{b} \rightarrow B_s^0)$ , the LEP  $B_s^0$  production fraction. The first four were evaluated using  $B(\bar{b} \rightarrow B_s^0) = (10.7 \pm 1.4)\%$  and the rest assume  $B(\bar{b} \rightarrow B_s^0) = 12\%$ .

The branching fraction  $B(B_s^0 \rightarrow D_s^- \ell^+ \nu_\ell \text{anything})$  is not a pure measurement since the measured product branching fraction  $B(\bar{b} \rightarrow B_s^0) \times B(B_s^0 \rightarrow D_s^- \ell^+ \nu_\ell \text{anything})$  was used to determine  $B(\bar{b} \rightarrow B_s^0)$ , as described in the note on “ $B^0 - \bar{B}^0$  Mixing”

For inclusive branching fractions, e.g.,  $B \rightarrow D^\pm \text{anything}$ , the values usually are multiplicities, not branching fractions. They can be greater than one.

Mode	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level
$\Gamma_1 D_s^- \text{anything}$	(93 $\pm$ 25) %	
$\Gamma_2 D_s^- \ell^+ \nu_\ell \text{anything}$	[a] ( 7.9 $\pm$ 2.4) %	
$\Gamma_3 D_s^- \pi^+$	( 3.0 $\pm$ 0.7) $\times 10^{-3}$	
$\Gamma_4 D_s^- \pi^+ \pi^+ \pi^-$	( 8.4 $\pm$ 3.3) $\times 10^{-3}$	
$\Gamma_5 D_s^{(*)+} D_s^{(*)-}$	(12 $\pm$ 6) %	
$\Gamma_6 J/\psi(1S)\phi$	( 9.3 $\pm$ 3.3) $\times 10^{-4}$	
$\Gamma_7 J/\psi(1S)\pi^0$	< 1.2 $\times 10^{-3}$	90%
$\Gamma_8 J/\psi(1S)\eta$	< 3.8 $\times 10^{-3}$	90%
$\Gamma_9 \psi(2S)\phi$	( 4.8 $\pm$ 2.2) $\times 10^{-4}$	
$\Gamma_{10} \pi^+ \pi^-$	< 1.7 $\times 10^{-6}$	90%
$\Gamma_{11} \pi^0 \pi^0$	< 2.1 $\times 10^{-4}$	90%
$\Gamma_{12} \eta \pi^0$	< 1.0 $\times 10^{-3}$	90%
$\Gamma_{13} \eta \eta$	< 1.5 $\times 10^{-3}$	90%
$\Gamma_{14} \rho^0 \rho^0$	< 3.20 $\times 10^{-4}$	90%
$\Gamma_{15} \phi \rho^0$	< 6.17 $\times 10^{-4}$	90%
$\Gamma_{16} \phi \phi$	( 1.4 $\pm$ 0.8) $\times 10^{-5}$	
$\Gamma_{17} \pi^+ K^-$	< 5.6 $\times 10^{-6}$	90%
$\Gamma_{18} K^+ K^-$	( 3.3 $\pm$ 0.9) $\times 10^{-5}$	
$\Gamma_{19} \bar{K}^*(892)^0 \rho^0$	< 7.67 $\times 10^{-4}$	90%
$\Gamma_{20} \bar{K}^*(892)^0 K^*(892)^0$	< 1.681 $\times 10^{-3}$	90%
$\Gamma_{21} \phi K^*(892)^0$	< 1.013 $\times 10^{-3}$	90%
$\Gamma_{22} p \bar{p}$	< 5.9 $\times 10^{-5}$	90%
$\Gamma_{23} \gamma \gamma$	B1 < 1.48 $\times 10^{-4}$	90%
$\Gamma_{24} \phi \gamma$	< 1.2 $\times 10^{-4}$	90%

**Lepton Family number (*LF*) violating modes or  
 $\Delta B = 1$  weak neutral current (*B1*) modes**

$\Gamma_{25}$	$\mu^+ \mu^-$	<i>B1</i>	< 1.5	$\times 10^{-7}$	90%
$\Gamma_{26}$	$e^+ e^-$	<i>B1</i>	< 5.4	$\times 10^{-5}$	90%
$\Gamma_{27}$	$e^\pm \mu^\mp$	<i>LF</i>	[ <i>b</i> ] < 6.1	$\times 10^{-6}$	90%
$\Gamma_{28}$	$\phi(1020) \mu^+ \mu^-$	<i>B1</i>	< 3.2	$\times 10^{-6}$	90%
$\Gamma_{29}$	$\phi \nu \bar{\nu}$	<i>B1</i>	< 5.4	$\times 10^{-3}$	90%

[a] Not a pure measurement. See note at head of  $B_s^0$  Decay Modes.

[b] The value is for the sum of the charge states or particle/antiparticle states indicated.

**$B_s^0$  BRANCHING RATIOS**

$\Gamma(D_s^- \text{ anything})/\Gamma_{\text{total}}$	$\Gamma_1/\Gamma$
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VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
<b>0.93<math>\pm</math>0.25 OUR AVERAGE</b>					
0.91 $\pm$ 0.18 $\pm$ 0.41		37 DRUTSKOY	07 BELL	$e^+ e^- \rightarrow \gamma(4S)$	
0.81 $\pm$ 0.24 $\pm$ 0.22	90	38 BUSKULIC	96E ALEP	$e^+ e^- \rightarrow Z$	
1.56 $\pm$ 0.58 $\pm$ 0.44	147	39 ACTON	92N OPAL	$e^+ e^- \rightarrow Z$	
37 The extraction of this result takes into account the correlation between the measurements of $B(\gamma(5S) \rightarrow D_s^- X)$ and $B(\gamma(5S) \rightarrow D_s^0 X)$ .					
38 BUSKULIC 96E separate $c\bar{c}$ and $b\bar{b}$ sources of $D_s^+$ mesons using a lifetime tag, subtract generic $\bar{b} \rightarrow W^+ \rightarrow D_s^+$ events, and obtain $B(\bar{b} \rightarrow B_s^0) \times B(B_s^0 \rightarrow D_s^- \text{ anything}) = 0.088 \pm 0.020 \pm 0.020$ assuming $B(D_s \rightarrow \phi\pi) = (3.5 \pm 0.4) \times 10^{-2}$ and PDG 1994 values for the relative partial widths to other $D_s$ channels. We evaluate using our current values $B(\bar{b} \rightarrow B_s^0) = 0.107 \pm 0.014$ and $B(D_s \rightarrow \phi\pi) = 0.036 \pm 0.009$ . Our first error is their experiment's and our second error is that due to $B(\bar{b} \rightarrow B_s^0)$ and $B(D_s \rightarrow \phi\pi)$ .					
39 ACTON 92N assume that excess of $147 \pm 48$ $D_s^0$ events over that expected from $B^0$ , $B^+$ , and $c\bar{c}$ is all from $B_s^0$ decay. The product branching fraction is measured to be $B(\bar{b} \rightarrow B_s^0)B(B_s^0 \rightarrow D_s^- \text{ anything}) \times B(D_s^- \rightarrow \phi\pi^-) = (5.9 \pm 1.9 \pm 1.1) \times 10^{-3}$ . We evaluate using our current values $B(\bar{b} \rightarrow B_s^0) = 0.107 \pm 0.014$ and $B(D_s \rightarrow \phi\pi) = 0.036 \pm 0.009$ . Our first error is their experiment's and our second error is that due to $B(\bar{b} \rightarrow B_s^0)$ and $B(D_s \rightarrow \phi\pi)$ .					

$\Gamma(D_s^- \ell^+ \nu_\ell \text{ anything})/\Gamma_{\text{total}}$	$\Gamma_2/\Gamma$
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The values and averages in this section serve only to show what values result if one assumes our  $B(\bar{b} \rightarrow B_s^0)$ . They cannot be thought of as measurements since the underlying product branching fractions were also used to determine  $B(\bar{b} \rightarrow B_s^0)$  as described in the note on "Production and Decay of *b*-Flavored Hadrons."

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>0.079±0.024 OUR AVERAGE</b>				
0.076±0.012±0.021	134	40 BUSKULIC	950 ALEP	$e^+ e^- \rightarrow Z$
0.107±0.043±0.029		41 ABREU	92M DLPH	$e^+ e^- \rightarrow Z$
0.103±0.036±0.028	18	42 ACTON	92N OPAL	$e^+ e^- \rightarrow Z$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.13 ±0.04 ±0.04	27	43 BUSKULIC	92E ALEP	$e^+ e^- \rightarrow Z$
40 BUSKULIC 950 use $D_s \ell$ correlations. The measured product branching ratio is $B(\bar{b} \rightarrow B_s) \times B(B_s \rightarrow D_s^- \ell^+ \nu_\ell \text{anything}) = (0.82 \pm 0.09^{+0.13}_{-0.14})\%$ assuming $B(D_s \rightarrow \phi\pi) = (3.5 \pm 0.4) \times 10^{-2}$ and PDG 1994 values for the relative partial widths to the six other $D_s$ channels used in this analysis. Combined with results from $\Upsilon(4S)$ experiments this can be used to extract $B(\bar{b} \rightarrow B_s) = (11.0 \pm 1.2^{+2.5}_{-2.6})\%$ . We evaluate using our current values $B(\bar{b} \rightarrow B_s^0) = 0.107 \pm 0.014$ and $B(D_s \rightarrow \phi\pi) = 0.036 \pm 0.009$ . Our first error is their experiment's and our second error is that due to $B(\bar{b} \rightarrow B_s^0)$ and $B(D_s \rightarrow \phi\pi)$ .				
41 ABREU 92M measured muons only and obtained product branching ratio $B(Z \rightarrow b \text{ or } \bar{b}) \times B(\bar{b} \rightarrow B_s) \times B(B_s \rightarrow D_s \mu^+ \nu_\mu \text{anything}) \times B(D_s \rightarrow \phi\pi) = (18 \pm 8) \times 10^{-5}$ . We evaluate using our current values $B(\bar{b} \rightarrow B_s^0) = 0.107 \pm 0.014$ and $B(D_s \rightarrow \phi\pi) = 0.036 \pm 0.009$ . Our first error is their experiment's and our second error is that due to $B(\bar{b} \rightarrow B_s^0)$ and $B(D_s \rightarrow \phi\pi)$ . We use $B(Z \rightarrow b \text{ or } \bar{b}) = 2B(Z \rightarrow b\bar{b}) = 2 \times (0.2212 \pm 0.0019)$ .				
42 ACTON 92N is measured using $D_s \rightarrow \phi\pi^+$ and $K^*(892)^0 K^+$ events. The product branching fraction measured is measured to be $B(\bar{b} \rightarrow B_s^0)B(B_s^0 \rightarrow D_s^- \ell^+ \nu_\ell \text{anything}) \times B(D_s^- \rightarrow \phi\pi^-) = (3.9 \pm 1.1 \pm 0.8) \times 10^{-4}$ . We evaluate using our current values $B(\bar{b} \rightarrow B_s^0) = 0.107 \pm 0.014$ and $B(D_s \rightarrow \phi\pi) = 0.036 \pm 0.009$ . Our first error is their experiment's and our second error is that due to $B(\bar{b} \rightarrow B_s^0)$ and $B(D_s \rightarrow \phi\pi)$ .				
43 BUSKULIC 92E is measured using $D_s \rightarrow \phi\pi^+$ and $K^*(892)^0 K^+$ events. They use $2.7 \pm 0.7\%$ for the $\phi\pi^+$ branching fraction. The average product branching fraction is measured to be $B(\bar{b} \rightarrow B_s^0)B(B_s^0 \rightarrow D_s^- \ell^+ \nu_\ell \text{anything}) = 0.020 \pm 0.005^{+0.005}_{-0.006}$ . We evaluate using our current values $B(\bar{b} \rightarrow B_s^0) = 0.107 \pm 0.014$ and $B(D_s \rightarrow \phi\pi) = 0.036 \pm 0.009$ . Our first error is their experiment's and our second error is that due to $B(\bar{b} \rightarrow B_s^0)$ and $B(D_s \rightarrow \phi\pi)$ . Superseded by BUSKULIC 950.				

$\Gamma(D_s^- \pi^+)/\Gamma_{\text{total}}$			$\Gamma_3/\Gamma$	
<u>VALUE (units <math>10^{-3}</math>)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>3.0±0.7±0.1</b>				
3.5±1.1±0.2		44 ABULENCIA	07C CDF	$p\bar{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<130	6	45 ABULENCIA	06J CDF	Repl. by ABULENCIA 07C
seen	1	46 AKERS	94J OPAL	$e^+ e^- \rightarrow Z$
		1	BUSKULIC	$e^+ e^- \rightarrow Z$

<sup>44</sup> ABULENCIA 07C reports  $[B(B_s^0 \rightarrow D_s^- \pi^+) / B(B^0 \rightarrow D^- \pi^+)] = 1.13 \pm 0.08 \pm 0.23$ .

We multiply by our best value  $B(B^0 \rightarrow D^- \pi^+) = (2.68 \pm 0.13) \times 10^{-3}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

<sup>45</sup> ABULENCIA 06J reports  $[B(B_s^0 \rightarrow D_s^- \pi^+) / B(B^0 \rightarrow D^- \pi^+)] = 1.32 \pm 0.18 \pm 0.38$ .

We multiply by our best value  $B(B^0 \rightarrow D^- \pi^+) = (2.68 \pm 0.13) \times 10^{-3}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

<sup>46</sup> AKERS 94J sees  $\leq 6$  events and measures the limit on the product branching fraction

$f(\bar{b} \rightarrow B_s^0) \cdot B(B_s^0 \rightarrow D_s^- \pi^+) < 1.3\%$  at CL = 90%. We divide by our current value  $B(\bar{b} \rightarrow B_s^0) = 0.105$ .

### $\Gamma(D_s^- \pi^+ \pi^+ \pi^-) / \Gamma_{\text{total}}$

$\Gamma_4 / \Gamma$

VALUE (units $10^{-3}$ )	DOCUMENT ID	TECN	COMMENT
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**8.4 ± 1.9 ± 2.7** 47 ABULENCIA 07C CDF  $p\bar{p}$  at 1.96 TeV

<sup>47</sup> ABULENCIA 07C reports  $[B(B_s^0 \rightarrow D_s^- \pi^+ \pi^+ \pi^-) / B(B^0 \rightarrow D^- \pi^+ \pi^+ \pi^-)] =$

$1.05 \pm 0.10 \pm 0.22$ . We multiply by our best value  $B(B^0 \rightarrow D^- \pi^+ \pi^+ \pi^-) = (8.0 \pm 2.5) \times 10^{-3}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

### $\Gamma(D_s^{(*)+} D_s^{(*)-}) / \Gamma_{\text{total}}$

$\Gamma_5 / \Gamma$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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**0.12 ± 0.05 ± 0.10** 48 BARATE 00K ALEP  $e^+ e^- \rightarrow Z$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.218 90 BARATE 98Q ALEP  $e^+ e^- \rightarrow Z$

<sup>48</sup> Uses  $\phi\phi$  correlations from  $B_s^0$  (short)  $\rightarrow D_s^{(*)+} D_s^{(*)-}$ .

### $\Gamma(J/\psi(1S)\phi) / \Gamma_{\text{total}}$

$\Gamma_6 / \Gamma$

VALUE (units $10^{-3}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
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**0.93 ± 0.28 ± 0.17** 49 ABE 96Q CDF  $p\bar{p}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<6 1 50 AKERS 94J OPAL  $e^+ e^- \rightarrow Z$

seen 14 51 ABE 93F CDF  $p\bar{p}$  at 1.8 TeV

seen 1 52 ACTON 92N OPAL Sup. by AKERS 94J

<sup>49</sup> ABE 96Q assumes  $f_u = f_d$  and  $f_s/f_u = 0.40 \pm 0.06$ . Uses  $B \rightarrow J/\psi(1S)K$  and  $B \rightarrow J/\psi(1S)K^*$  branching fractions from PDG 94. They quote two systematic errors, ±0.10 and ±0.14 where the latter is the uncertainty in  $f_s$ . We combine in quadrature.

<sup>50</sup> AKERS 94J sees one event and measures the limit on the product branching fraction  $f(\bar{b} \rightarrow B_s^0) \cdot B(B_s^0 \rightarrow J/\psi(1S)\phi) < 7 \times 10^{-4}$  at CL = 90%. We divide by  $B(\bar{b} \rightarrow B_s^0) = 0.112$ .

<sup>51</sup> ABE 93F measured using  $J/\psi(1S) \rightarrow \mu^+ \mu^-$  and  $\phi \rightarrow K^+ K^-$ .

<sup>52</sup> In ACTON 92N a limit on the product branching fraction is measured to be

$f(\bar{b} \rightarrow B_s^0) \cdot B(B_s^0 \rightarrow J/\psi(1S)\phi) \leq 0.22 \times 10^{-2}$ .

### $\Gamma(J/\psi(1S)\pi^0)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN
$<1.2 \times 10^{-3}$	90	53 ACCIARRI	97C L3

53 ACCIARRI 97C assumes  $B^0$  production fraction ( $39.5 \pm 4.0\%$ ) and  $B_s$  ( $12.0 \pm 3.0\%$ ).

### $\Gamma_7/\Gamma$

### $\Gamma(J/\psi(1S)\eta)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN
$<3.8 \times 10^{-3}$	90	54 ACCIARRI	97C L3

54 ACCIARRI 97C assumes  $B^0$  production fraction ( $39.5 \pm 4.0\%$ ) and  $B_s$  ( $12.0 \pm 3.0\%$ ).

### $\Gamma_8/\Gamma$

### $\Gamma(\psi(2S)\phi)/\Gamma_{\text{total}}$

VALUE (units $10^{-4}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
$4.8 \pm 1.4 \pm 1.7$		55 ABULENCIA	06N CDF	$p\bar{p}$ at 1.96 TeV

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen 1 BUSKULIC 93G ALEP  $e^+e^- \rightarrow Z$

55 ABULENCIA 06N reports  $[B(B_s^0 \rightarrow \psi(2S)\phi) / B(B_s^0 \rightarrow J/\psi(1S)\phi)] = 0.52 \pm 0.13 \pm 0.07$ . We multiply by our best value  $B(B_s^0 \rightarrow J/\psi(1S)\phi) = (9.3 \pm 3.3) \times 10^{-4}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

### $\Gamma_9/\Gamma$

### $\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$

VALUE (units $10^{-6}$ )	CL%	DOCUMENT ID	TECN	COMMENT
$< 1.7$	90	56 ABULENCIA,A 06D	CDF	$p\bar{p}$ at 1.96 TeV

• • • We do not use the following data for averages, fits, limits, etc. • • •

$<232$  90 57 ABE 00C SLD  $e^+e^- \rightarrow Z$

$<170$  90 58 BUSKULIC 96V ALEP  $e^+e^- \rightarrow Z$

56 ABULENCIA,A 06D obtains this from  $B(B_s \rightarrow \pi^+\pi^-) / B(B_s \rightarrow K^+K^-) < 0.05$  at 90% CL, assuming  $B(B_s \rightarrow K^+K^-) = (33 \pm 6 \pm 7) \times 10^{-6}$ .

57 ABE 00C assumes  $B(Z \rightarrow b\bar{b}) = (21.7 \pm 0.1)\%$  and the  $B$  fractions  $f_{B^0} = f_{B^+} = (39.7^{+1.8}_{-2.2})\%$  and  $f_{B_s} = (10.5^{+1.8}_{-2.2})\%$ .

58 BUSKULIC 96V assumes PDG 96 production fractions for  $B^0$ ,  $B^+$ ,  $B_s$ ,  $b$  baryons.

### $\Gamma_{10}/\Gamma$

### $\Gamma(\pi^0\pi^0)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.1 \times 10^{-4}$	90	59 ACCIARRI	95H L3	$e^+e^- \rightarrow Z$

59 ACCIARRI 95H assumes  $f_{B^0} = 39.5 \pm 4.0$  and  $f_{B_s} = 12.0 \pm 3.0\%$ .

### $\Gamma_{11}/\Gamma$

### $\Gamma(\eta\pi^0)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.0 \times 10^{-3}$	90	60 ACCIARRI	95H L3	$e^+e^- \rightarrow Z$

60 ACCIARRI 95H assumes  $f_{B^0} = 39.5 \pm 4.0$  and  $f_{B_s} = 12.0 \pm 3.0\%$ .

### $\Gamma_{12}/\Gamma$

### $\Gamma(\eta\eta)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT	$\Gamma_{13}/\Gamma$
$<1.5 \times 10^{-3}$	90	61 ACCIARRI	95H L3	$e^+ e^- \rightarrow Z$	
<sup>61</sup> ACCIARRI 95H assumes $f_{B^0} = 39.5 \pm 4.0$ and $f_{B_s} = 12.0 \pm 3.0\%$ .					

### $\Gamma(\rho^0\rho^0)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT	$\Gamma_{14}/\Gamma$
$<3.20 \times 10^{-4}$	90	62 ABE	00C SLD	$e^+ e^- \rightarrow Z$	
<sup>62</sup> ABE 00C assumes $B(Z \rightarrow b\bar{b}) = (21.7 \pm 0.1)\%$ and the $B$ fractions $f_{B^0} = f_{B^+} = (39.7^{+1.8}_{-2.2})\%$ and $f_{B_s} = (10.5^{+1.8}_{-2.2})\%$ .					

### $\Gamma(\phi\rho^0)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT	$\Gamma_{15}/\Gamma$
$<6.17 \times 10^{-4}$	90	63 ABE	00C SLD	$e^+ e^- \rightarrow Z$	
<sup>63</sup> ABE 00C assumes $B(Z \rightarrow b\bar{b}) = (21.7 \pm 0.1)\%$ and the $B$ fractions $f_{B^0} = f_{B^+} = (39.7^{+1.8}_{-2.2})\%$ and $f_{B_s} = (10.5^{+1.8}_{-2.2})\%$ .					

### $\Gamma(\phi\phi)/\Gamma_{\text{total}}$

VALUE (units $10^{-6}$ )	CL%	DOCUMENT ID	TECN	COMMENT	$\Gamma_{16}/\Gamma$
$14^{+6}_{-5} \pm 6$		64 ACOSTA	05J CDF	$p\bar{p}$ at 1.96 TeV	

• • • We do not use the following data for averages, fits, limits, etc. • • •

<1183	90	65 ABE	00C SLD	$e^+ e^- \rightarrow Z$
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<sup>64</sup> Uses  $B(B^0 \rightarrow J/\psi\phi) = (1.38 \pm 0.49) \times 10^{-3}$  and production cross-section ratio of  $\sigma(B_s)/\sigma(B^0) = 0.26 \pm 0.04$ .

<sup>65</sup> ABE 00C assumes  $B(Z \rightarrow b\bar{b}) = (21.7 \pm 0.1)\%$  and the  $B$  fractions  $f_{B^0} = f_{B^+} = (39.7^{+1.8}_{-2.2})\%$  and  $f_{B_s} = (10.5^{+1.8}_{-2.2})\%$ .

### $\Gamma(\pi^+ K^-)/\Gamma_{\text{total}}$

VALUE (units $10^{-6}$ )	CL%	DOCUMENT ID	TECN	COMMENT	$\Gamma_{17}/\Gamma$
< 5.6	90	66 ABULENCIA,A 06D	CDF	$p\bar{p}$ at 1.96 TeV	

• • • We do not use the following data for averages, fits, limits, etc. • • •

<261	90	67 ABE	00C SLD	$e^+ e^- \rightarrow Z$
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<210	90	68 BUSKULIC	96V ALEP	$e^+ e^- \rightarrow Z$
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<260	90	69 AKERS	94L OPAL	$e^+ e^- \rightarrow Z$
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<sup>66</sup> ABULENCIA,A 06D obtains this from  $(f_s/f_d) (B(B_s \rightarrow \pi^+ K^-) / B(B^0 \rightarrow K^+ \pi^-)) < 0.08$  at 90% CL, assuming  $f_s/f_d = 0.260 \pm 0.039$  and  $B(B^0 \rightarrow K^+ \pi^-) = (18.9 \pm 0.7) \times 10^{-6}$ .

<sup>67</sup> ABE 00C assumes  $B(Z \rightarrow b\bar{b}) = (21.7 \pm 0.1)\%$  and the  $B$  fractions  $f_{B^0} = f_{B^+} = (39.7^{+1.8}_{-2.2})\%$  and  $f_{B_s} = (10.5^{+1.8}_{-2.2})\%$ .

<sup>68</sup> BUSKULIC 96V assumes PDG 96 production fractions for  $B^0$ ,  $B^+$ ,  $B_s$ ,  $b$  baryons.

<sup>69</sup> Assumes  $B(Z \rightarrow b\bar{b}) = 0.217$  and  $B_d^0$  ( $B_s^0$ ) fraction 39.5% (12%).

$\Gamma(K^+K^-)/\Gamma_{\text{total}}$  $\Gamma_{18}/\Gamma$ 

<u>VALUE</u> (units $10^{-5}$ )	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>3.3 \pm 0.6 \pm 0.7</math></b>	70	ABULENCIA,A 06D	CDF	$p\bar{p}$ at 1.96 TeV

• • • We do not use the following data for averages, fits, limits, etc. • • •

<28.3	90	71 ABE	00C SLD	$e^+e^- \rightarrow Z$
< 5.9	90	72 BUSKULIC	96V ALEP	$e^+e^- \rightarrow Z$
<14	90	73 AKERS	94L OPAL	$e^+e^- \rightarrow Z$

70 ABULENCIA,A 06D obtains this from  $(f_s/f_d)$   $(B(B_s \rightarrow K^+K^-) / B(B^0 \rightarrow K^+\pi^-)) = 0.46 \pm 0.08 \pm 0.07$ , assuming  $f_s/f_d = 0.260 \pm 0.039$  and  $B(B^0 \rightarrow K^+\pi^-) = (18.9 \pm 0.7) \times 10^{-6}$ .

71 ABE 00C assumes  $B(Z \rightarrow b\bar{b}) = (21.7 \pm 0.1)\%$  and the  $B$  fractions  $f_{B^0} = f_{B^+} = (39.7^{+1.8}_{-2.2})\%$  and  $f_{B_s} = (10.5^{+1.8}_{-2.2})\%$ .

72 BUSKULIC 96V assumes PDG 96 production fractions for  $B^0$ ,  $B^+$ ,  $B_s$ ,  $b$  baryons.

73 Assumes  $B(Z \rightarrow b\bar{b}) = 0.217$  and  $B_d^0$  ( $B_s^0$ ) fraction 39.5% (12%).

 $\Gamma(\bar{K}^*(892)^0 \rho^0)/\Gamma_{\text{total}}$  $\Gamma_{19}/\Gamma$ 

<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>&lt;7.67 \times 10^{-4}</math></b>	90	74 ABE	00C SLD	$e^+e^- \rightarrow Z$

74 ABE 00C assumes  $B(Z \rightarrow b\bar{b}) = (21.7 \pm 0.1)\%$  and the  $B$  fractions  $f_{B^0} = f_{B^+} = (39.7^{+1.8}_{-2.2})\%$  and  $f_{B_s} = (10.5^{+1.8}_{-2.2})\%$ .

 $\Gamma(\bar{K}^*(892)^0 K^*(892)^0)/\Gamma_{\text{total}}$  $\Gamma_{20}/\Gamma$ 

<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>&lt;16.81 \times 10^{-4}</math></b>	90	75 ABE	00C SLD	$e^+e^- \rightarrow Z$

75 ABE 00C assumes  $B(Z \rightarrow b\bar{b}) = (21.7 \pm 0.1)\%$  and the  $B$  fractions  $f_{B^0} = f_{B^+} = (39.7^{+1.8}_{-2.2})\%$  and  $f_{B_s} = (10.5^{+1.8}_{-2.2})\%$ .

 $\Gamma(\phi K^*(892)^0)/\Gamma_{\text{total}}$  $\Gamma_{21}/\Gamma$ 

<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>&lt;10.13 \times 10^{-4}</math></b>	90	76 ABE	00C SLD	$e^+e^- \rightarrow Z$

76 ABE 00C assumes  $B(Z \rightarrow b\bar{b}) = (21.7 \pm 0.1)\%$  and the  $B$  fractions  $f_{B^0} = f_{B^+} = (39.7^{+1.8}_{-2.2})\%$  and  $f_{B_s} = (10.5^{+1.8}_{-2.2})\%$ .

 $\Gamma(p\bar{p})/\Gamma_{\text{total}}$  $\Gamma_{22}/\Gamma$ 

Test for  $\Delta B=1$  weak neutral current. Allowed by higher-order electroweak interactions.

<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>&lt;5.9 \times 10^{-5}</math></b>	90	77 BUSKULIC	96V ALEP	$e^+e^- \rightarrow Z$

77 BUSKULIC 96V assumes PDG 96 production fractions for  $B^0$ ,  $B^+$ ,  $B_s$ ,  $b$  baryons.

 $\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$  $\Gamma_{23}/\Gamma$ 

Test for  $\Delta B=1$  weak neutral current.

<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>&lt;14.8 \times 10^{-5}</math></b>	90	78 ACCIARRI	95I L3	$e^+e^- \rightarrow Z$

78 ACCIARRI 95I assumes  $f_{B^0} = 39.5 \pm 4.0$  and  $f_{B_s} = 12.0 \pm 3.0\%$ .

$\Gamma(\phi\gamma)/\Gamma_{\text{total}}$  $\Gamma_{24}/\Gamma$ 

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.2 \times 10^{-4}$	90	ACOSTA 02G	CDF	$p\bar{p}$ at 1.8 TeV
$\bullet \bullet \bullet$ We do not use the following data for averages, fits, limits, etc. $\bullet \bullet \bullet$				
$<7 \times 10^{-4}$	90	79 ADAM 96D	DLPH	$e^+ e^- \rightarrow Z$
79 ADAM 96D assumes $f_{B^0} = f_{B^-} = 0.39$ and $f_{B_s} = 0.12$ .				

 $\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$  $\Gamma_{25}/\Gamma$ Test for  $\Delta B = 1$  weak neutral current.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.5 \times 10^{-7}$	90	80 ABULENCIA 05	CDF	$p\bar{p}$ at 1.96 TeV
$\bullet \bullet \bullet$ We do not use the following data for averages, fits, limits, etc. $\bullet \bullet \bullet$				
$<4.1 \times 10^{-7}$	90	81 ABAZOV 05E	D0	$p\bar{p}$ at 1.96 TeV
$<5.8 \times 10^{-7}$	90	82 ACOSTA 04D	CDF	$p\bar{p}$ at 1.96 TeV
$<2.0 \times 10^{-6}$	90	83 ABE 98	CDF	$p\bar{p}$ at 1.8 TeV
$<3.8 \times 10^{-5}$	90	84 ACCIARRI 97B	L3	$e^+ e^- \rightarrow Z$
$<8.4 \times 10^{-6}$	90	85 ABE 96L	CDF	Repl. by ABE 98
80 Assumes production cross section $\sigma(B^+)/\sigma(B_s) = 3.71 \pm 0.41$ and $B(B^+ \rightarrow J/\psi K^+ \rightarrow \mu^+ \mu^- K^+) = (5.88 \pm 0.26) \times 10^{-5}$ .				
81 Assumes production cross-section $\sigma(B_s)/\sigma(B^+) = 0.270 \pm 0.034$ .				
82 Assumes production cross-section $\sigma(B_s)/\sigma(B^+) = 0.100/0.391$ and the CDF measured value of $\sigma(B^+) = 3.6 \pm 0.6 \mu\text{b}$ .				
83 ABE 98 assumes production of $\sigma(B^0) = \sigma(B^+)$ and $\sigma(B_s)/\sigma(B^0) = 1/3$ . They normalize to their measured $\sigma(B^0, p_T(B) > 6,  y  < 1.0) = 2.39 \pm 0.32 \pm 0.44 \mu\text{b}$ .				
84 ACCIARRI 97B assume PDG 96 production fractions for $B^+$ , $B^0$ , $B_s$ , and $\Lambda_b$ .				
85 ABE 96L assumes $B^+/B_s$ production ratio 3/1. They normalize to their measured $\sigma(B^+, p_T(B) > 6 \text{ GeV}/c,  y  < 1) = 2.39 \pm 0.54 \mu\text{b}$ .				

 $\Gamma(e^+e^-)/\Gamma_{\text{total}}$  $\Gamma_{26}/\Gamma$ Test for  $\Delta B = 1$  weak neutral current.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<5.4 \times 10^{-5}$	90	86 ACCIARRI 97B	L3	$e^+ e^- \rightarrow Z$
86 ACCIARRI 97B assume PDG 96 production fractions for $B^+$ , $B^0$ , $B_s$ , and $\Lambda_b$ .				

 $\Gamma(e^\pm\mu^\mp)/\Gamma_{\text{total}}$  $\Gamma_{27}/\Gamma$ 

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<6.1 \times 10^{-6}$	90	ABE 98V	CDF	$p\bar{p}$ at 1.8 TeV
$\bullet \bullet \bullet$ We do not use the following data for averages, fits, limits, etc. $\bullet \bullet \bullet$				
$<4.1 \times 10^{-5}$	90	87 ACCIARRI 97B	L3	$e^+ e^- \rightarrow Z$
87 ACCIARRI 97B assume PDG 96 production fractions for $B^+$ , $B^0$ , $B_s$ , and $\Lambda_b$ .				

 $\Gamma(\phi(1020)\mu^+\mu^-)/\Gamma_{\text{total}}$  $\Gamma_{28}/\Gamma$ Test for  $\Delta B = 1$  weak neutral current.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<3.2 \times 10^{-6}$	90	88 ABAZOV 06G	D0	$p\bar{p}$ at 1.96 TeV
$\bullet \bullet \bullet$ We do not use the following data for averages, fits, limits, etc. $\bullet \bullet \bullet$				
$<4.7 \times 10^{-5}$	90	ACOSTA 02D	CDF	$p\bar{p}$ at 1.8 TeV
88 Uses $B(B_s^0 \rightarrow J/\psi\phi) = 9.3 \times 10^{-4}$ .				

$\Gamma(\phi\nu\bar{\nu})/\Gamma_{\text{total}}$	$\Gamma_{29}/\Gamma$
Test for $\Delta B = 1$ weak neutral current.	
<u>VALUE</u>	<u>CL%</u>
$<5.4 \times 10^{-3}$	90
89 ADAM	89 ADAM
	96D DLPH
	$e^+ e^- \rightarrow Z$
89 ADAM 96D assumes $f_{B^0} = f_{B^-} = 0.39$ and $f_{B_s} = 0.12$ .	

## POLARIZATION IN $B_s^0$ DECAY

### $\Gamma_L/\Gamma$ in $B_s^0 \rightarrow J/\psi(1S)\phi$

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>0.59±0.12 OUR AVERAGE</b>				
$0.61 \pm 0.14 \pm 0.02$	90	AFFOLDER	00N CDF	$p\bar{p}$ at 1.8 TeV
$0.56 \pm 0.21^{+0.02}_{-0.04}$	19	ABE	95Z CDF	$p\bar{p}$ at 1.8 TeV

90 AFFOLDER 00N measurements are based on 40  $B_s^0$  candidates obtained from a data sample of  $89 \text{ pb}^{-1}$ . The  $P$ -wave fraction is found to be  $0.23 \pm 0.19 \pm 0.04$ .

## $B_s^0$ - $\bar{B}_s^0$ MIXING

For a discussion of  $B_s^0$ - $\bar{B}_s^0$  mixing see the note on “ $B^0$ - $\bar{B}^0$  Mixing” in the  $B^0$  Particle Listings above.

$\chi_s$  is a measure of the time-integrated  $B_s^0$ - $\bar{B}_s^0$  mixing probability that produced  $B_s^0(\bar{B}_s^0)$  decays as a  $\bar{B}_s^0(B_s^0)$ . Mixing violates  $\Delta B \neq 2$  rule.

$$\chi_s = \frac{x_s^2}{2(1+x_s^2)}$$

$$x_s = \frac{\Delta m_{B_s^0}}{\Gamma_{B_s^0}} = (m_{B_{sH}^0} - m_{B_{sL}^0}) \tau_{B_s^0},$$

where  $H, L$  stand for heavy and light states of two  $B_s^0$   $CP$  eigenstates and

$$\tau_{B_s^0} = \frac{1}{0.5(\Gamma_{B_{sH}^0} + \Gamma_{B_{sL}^0})}.$$

$$\Delta m_{B_s^0} = m_{B_{sH}^0} - m_{B_{sL}^0}$$

$\Delta m_{B_s^0}$  is a measure of  $2\pi$  times the  $B_s^0$ - $\bar{B}_s^0$  oscillation frequency in time-dependent mixing experiments.

<u>VALUE</u> ( $10^{12} \text{ s}^{-1}$ )	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$17.77 \pm 0.10 \pm 0.07$	91	ABULENCIA,A 06G	CDF	$p\bar{p}$ at 1.96 TeV

• • • We do not use the following data for averages, fits, limits, etc. • • •

17–21	90	92 ABAZOV	06B D0	$p\bar{p}$ at 1.96 TeV
$17.31^{+0.33}_{-0.18} \pm 0.07$		93 ABULENCIA	06Q CDF	Repl. by ABULENCIA, A 06G
> 8.0	95	94 ABDALLAH	04J DLPH	$e^+ e^- \rightarrow Z^0$
> 4.9	95	95 ABDALLAH	04J DLPH	$e^+ e^- \rightarrow Z^0$
> 8.5	95	96 ABDALLAH	04J DLPH	$e^+ e^- \rightarrow Z^0$
> 5.0	95	97 ABDALLAH	03B DLPH	$e^+ e^- \rightarrow Z$
> 10.3	95	98 ABE	03 SLD	$e^+ e^- \rightarrow Z$
> 10.9	95	99 HEISTER	03E ALEP	$e^+ e^- \rightarrow Z$
> 5.3	95	100 ABE	02V SLD	$e^+ e^- \rightarrow Z$
> 1.0	95	101 ABBIENDI	01D OPAL	$e^+ e^- \rightarrow Z$
> 7.4	95	102 ABREU	00Y DLPH	Repl. by ABDALLAH 04J
> 4.0	95	103 ABREU,P	00G DLPH	$e^+ e^- \rightarrow Z$
> 5.2	95	104 ABBIENDI	99S OPAL	$e^+ e^- \rightarrow Z$
< 96	95	105 ABE	99D CDF	$p\bar{p}$ at 1.8 TeV
> 5.8	95	106 ABE	99J CDF	$p\bar{p}$ at 1.8 TeV
> 9.6	95	107 BARATE	99J ALEP	$e^+ e^- \rightarrow Z$
> 7.9	95	108 BARATE	98C ALEP	Repl. by BARATE 99J
> 3.1	95	109 ACKERSTAFF	97U OPAL	Repl. by ABBIENDI 99S
> 2.2	95	110 ACKERSTAFF	97V OPAL	Repl. by ABBIENDI 99S
> 6.5	95	111 ADAM	97 DLPH	Repl. by ABREU 00Y
> 6.6	95	112 BUSKULIC	96M ALEP	Repl. by BARATE 98C
> 2.2	95	110 AKERS	95J OPAL	Sup. by ACKERSTAFF 97V
> 5.7	95	113 BUSKULIC	95J ALEP	$e^+ e^- \rightarrow Z$
> 1.8	95	110 BUSKULIC	94B ALEP	$e^+ e^- \rightarrow Z$

91 Significance of oscillation signal is  $5.4 \sigma$ . Also reports  $|V_{td} / V_{ts}| = 0.2060 \pm 0.0007^{+0.0081}_{-0.0060}$ .

92 A likelihood scan over the oscillation frequency,  $\Delta m_s$ , gives a most probable value of  $19 \text{ ps}^{-1}$  and a range of  $17 < \Delta m_s < 21 \text{ (ps}^{-1})$  at 90% C.L. assuming Gaussian uncertainties. Also excludes  $\Delta m_s < 14.8 \text{ ps}^{-1}$  at 95% C.L.

93 Significance of oscillation signal is 0.2%. Also reported the value  $|V_{td} / V_{ts}| = 0.208^{+0.001+0.008}_{-0.002-0.006}$ .

94 Uses leptons emitted with large momentum transverse to a jet and improved techniques for vertexing and flavor-tagging.

95 Updates of  $D_s$ -lepton analysis.

96 Combined results from all Delphi analyses.

97 Events with a high transverse momentum lepton were removed and an inclusively reconstructed vertex was required.

98 ABE 03 uses the novel “charge dipole” technique to reconstruct separate secondary and tertiary vertices originating from the  $B \rightarrow D$  decay chain. The analysis excludes  $\Delta m_s < 4.9 \text{ ps}^{-1}$  and  $7.9 < \Delta m_s < 10.3 \text{ ps}^{-1}$ .

99 Three analyses based on complementary event selections: (1) fully-reconstructed hadronic decays; (2) semileptonic decays with  $D_s$  exclusively reconstructed; (3) inclusive semileptonic decays.

100 ABE 02V uses exclusively reconstructed  $D_s^-$  mesons and excludes  $\Delta m_s < 1.4 \text{ ps}^{-1}$  and  $2.4 < \Delta m_s < 5.3 \text{ ps}^{-1}$  at 95%CL.

101 Uses fully or partially reconstructed  $D_s \ell$  vertices and a mixing tag as a flavor tagging.

- 102 Replaced by ABDALLAH 04A. Uses  $D_s^- \ell^+$ , and  $\phi \ell^+$  vertices, and a multi-variable discriminant as a flavor tagging.  
 103 Uses inclusive  $D_s$  vertices and fully reconstructed  $B_s$  decays and a multi-variable discriminant as a flavor tagging.  
 104 Uses  $\ell\text{-}Q_{\text{hem}}$  and  $\ell\text{-}\ell$ .  
 105 ABE 99D assumes  $\tau_{B_s^0} = 1.55 \pm 0.05$  ps and  $\Delta\Gamma/\Delta m = (5.6 \pm 2.6) \times 10^{-3}$ .  
 106 ABE 99J uses  $\phi \ell\text{-}\ell$  correlation.  
 107 BARATE 99J uses combination of an inclusive lepton and  $D_s^-$ -based analyses.  
 108 BARATE 98C combines results from  $D_s h\text{-}\ell/Q_{\text{hem}}$ ,  $D_s h\text{-}K$  in the same side,  $D_s \ell\text{-}\ell/Q_{\text{hem}}$  and  $D_s \ell\text{-}K$  in the same side.  
 109 Uses  $\ell\text{-}Q_{\text{hem}}$ .  
 110 Uses  $\ell\text{-}\ell$ .  
 111 ADAM 97 combines results from  $D_s \ell\text{-}Q_{\text{hem}}$ ,  $\ell\text{-}Q_{\text{hem}}$ , and  $\ell\text{-}\ell$ .  
 112 BUSKULIC 96M uses  $D_s$  lepton correlations and lepton, kaon, and jet charge tags.  
 113 BUSKULIC 95J uses  $\ell\text{-}Q_{\text{hem}}$ . They find  $\Delta m_s > 5.6$  [ $> 6.1$ ] for  $f_s = 10\%$  [12%]. We interpolate to our central value  $f_s = 10.5\%$ .

$$x_s = \Delta m_{B_s^0} / \Gamma_{B_s^0}$$

This is derived by the Heavy Flavor Averaging Group (HFAG) from the results on  $\Delta m_{B_s^0}$  and "OUR EVALUATION" of the  $B_s^0$  mean lifetime.

<u>VALUE</u>	<u>DOCUMENT ID</u>
<b><math>25.5 \pm 0.6</math> OUR EVALUATION</b>	

$$\chi_s$$

This  $B_s^0\bar{B}_s^0$  integrated mixing parameter is derived from  $x_s$  above.

<u>VALUE</u>	<u>DOCUMENT ID</u>
<b><math>0.49924 \pm 0.00003</math> OUR EVALUATION</b>	

### CP VIOLATION PARAMETERS in $B_s^0$

$$\text{Re}(\epsilon_{B_s^0}) / (1 + |\epsilon_{B_s^0}|^2)$$

CP impurity in  $B_s^0$  system. It is obtained from either  $B_s^0$  decays or a mixture of the  $B_d^0$  and  $B_s^0$  decays where the effect from the  $B_s^0$  is isolated by using the  $B_d^0$  parameter obtained from the  $B$  factories.

"OUR EVALUATION" is an average using rescaled values of the data listed below. The average and rescaling were performed by the Heavy Flavor Averaging Group (HFAG) and are described at <http://www.slac.stanford.edu/xorg/hfag/>. The averaging/scaling procedure takes into account correlation between the measurements.

<u>VALUE (units <math>10^{-3}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>-0.75 \pm 2.52</math> OUR EVALUATION</b>			
<b><math>6.1 \pm 4.8 \pm 0.9</math></b>	114 ABAZOV	07A D0	$p\bar{p}$ at 1.96 TeV
114 The first direct measurement of the time integrated flavor untagged charge asymmetry in semileptonic $B_s^0$ decays is reported as $2xA_{SL}^s$ (untagged) = $A_{SL}^s = (2.45 \pm 1.93 \pm 0.35) \times 10^{-2}$ .			

***CP* Violation phase  $\phi_s$  in the  $B_s^0$  System**

$\phi_s$  is the *CP*-violating phase, defined as the relative phase of the off-diagonal elements of the mass and decay matrices in the  $B_s^0 \bar{B}_s^0$  system.

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>-0.79 \pm 0.56^{+0.14}_{-0.01}</math></b>	115 ABAZOV	07 D0	$p\bar{p}$ at 1.96 TeV
115 The first direct measurement of the <i>CP</i> -violating mixing phase is reported from the time-dependent analysis of flavor untagged $B_s^0 \rightarrow J/\psi \phi$ decays.			

 **$B_s^0$  REFERENCES**

ABAZOV	07	PRL 98 121801	V.M. Abazov <i>et al.</i>	(D0 Collab.)
ABAZOV	07A	PRL 98 151801	V.M. Abazov <i>et al.</i>	(D0 Collab.)
ABULENCIA	07C	PRL 98 061802	A. Abulencia <i>et al.</i>	(FNAL CDF Collab.)
DRUTSKOY	07	PRL 98 052001	A. Drutskoy <i>et al.</i>	(BELLE Collab.)
ABAZOV	06B	PRL 97 021802	V.M. Abazov <i>et al.</i>	(D0 Collab.)
ABAZOV	06G	PR D74 031107R	V.M. Abazov <i>et al.</i>	(D0 Collab.)
ABAZOV	06V	PRL 97 241801	V.M. Abazov <i>et al.</i>	(D0 Collab.)
ABULENCIA	06J	PRL 96 191801	A. Abulencia <i>et al.</i>	(CDF Collab.)
ABULENCIA	06N	PRL 96 231801	A. Abulencia <i>et al.</i>	(CDF Collab.)
ABULENCIA	06Q	PRL 97 062003	A. Abulencia <i>et al.</i>	(CDF Collab.)
ABULENCIA,A	06D	PRL 97 211802	A. Abulencia <i>et al.</i>	(CDF Collab.)
ABULENCIA,A	06G	PRL 97 242003	A. Abulencia <i>et al.</i>	(CDF Collab.)
ACOSTA	06	PRL 96 202001	D. Acosta <i>et al.</i>	(CDF Collab.)
ABAZOV	05B	PRL 94 042001	V.M. Abazov <i>et al.</i>	(D0 Collab.)
ABAZOV	05E	PRL 94 071802	V.M. Abazov <i>et al.</i>	(D0 Collab.)
ABAZOV	05W	PRL 95 171801	V.M. Abazov <i>et al.</i>	(D0 Collab.)
ABULENCIA	05	PRL 95 221805	A. Abulencia <i>et al.</i>	(CDF Collab.)
ACOSTA	05	PRL 94 101803	D. Acosta <i>et al.</i>	(CDF Collab.)
ACOSTA	05J	PRL 95 031801	D. Acosta <i>et al.</i>	(CDF Collab.)
ABDALLAH	04A	PL B585 63	J. Abdallah <i>et al.</i>	(DELPHI Collab.)
ABDALLAH	04J	EPJ C35 35	J. Abdallah <i>et al.</i>	(DELPHI Collab.)
ACOSTA	04D	PRL 93 032001	D. Acosta <i>et al.</i>	(CDF Collab.)
ABDALLAH	03B	EPJ C28 155	J. Abdallah <i>et al.</i>	(DELPHI Collab.)
ABE	03	PR D67 012006	K. Abe <i>et al.</i>	(SLD Collab.)
HEISTER	03E	EPJ C29 143	A. Heister <i>et al.</i>	(ALEPH Collab.)
ABE	02V	PR D66 032009	K. Abe <i>et al.</i>	(SLD Collab.)
ACOSTA	02D	PR D65 111101R	D. Acosta <i>et al.</i>	(CDF Collab.)
ACOSTA	02G	PR D66 112002	D. Acosta <i>et al.</i>	(CDF Collab.)
ABBIENDI	01D	EPJ C19 241	G. Abbiendi <i>et al.</i>	(OPAL Collab.)
ABE	00C	PR D62 071101R	K. Abe <i>et al.</i>	(SLD Collab.)
ABREU	00Y	EPJ C16 555	P. Abreu <i>et al.</i>	(DELPHI Collab.)
ABREU,P	00G	EPJ C18 229	P. Abreu <i>et al.</i>	(DELPHI Collab.)
AFFOLDER	00N	PRL 85 4668	T. Affolder <i>et al.</i>	(CDF Collab.)
BARATE	00K	PL B486 286	R. Barate <i>et al.</i>	(ALEPH Collab.)
ABBIENDI	99S	EPJ C11 587	G. Abbiendi <i>et al.</i>	(OPAL Collab.)
ABE	99D	PR D59 032004	F. Abe <i>et al.</i>	(CDF Collab.)
ABE	99J	PRL 82 3576	F. Abe <i>et al.</i>	(CDF Collab.)
BARATE	99J	EPJ C7 553	R. Barate <i>et al.</i>	(ALEPH Collab.)
Also		EPJ C12 181 (erratum)	R. Barate <i>et al.</i>	(ALEPH Collab.)
ABE	98	PR D57 R3811	F. Abe <i>et al.</i>	(CDF Collab.)
ABE	98B	PR D57 5382	F. Abe <i>et al.</i>	(CDF Collab.)
ABE	98V	PRL 81 5742	F. Abe <i>et al.</i>	(CDF Collab.)
ACCIARRI	98S	PL B438 417	M. Acciari <i>et al.</i>	(L3 Collab.)
ACKERSTAFF	98F	EPJ C2 407	K. Ackerstaff <i>et al.</i>	(OPAL Collab.)
ACKERSTAFF	98G	PL B426 161	K. Ackerstaff <i>et al.</i>	(OPAL Collab.)
BARATE	98C	EPJ C4 367	R. Barate <i>et al.</i>	(ALEPH Collab.)
BARATE	98Q	EPJ C4 387	R. Barate <i>et al.</i>	(ALEPH Collab.)
PDG	98	EPJ C3 1	C. Caso <i>et al.</i>	
ACCIARRI	97B	PL B391 474	M. Acciari <i>et al.</i>	(L3 Collab.)
ACCIARRI	97C	PL B391 481	M. Acciari <i>et al.</i>	(L3 Collab.)
ACKERSTAFF	97U	ZPHY C76 401	K. Ackerstaff <i>et al.</i>	(OPAL Collab.)
ACKERSTAFF	97V	ZPHY C76 417	K. Ackerstaff <i>et al.</i>	(OPAL Collab.)
ADAM	97	PL B414 382	W. Adam <i>et al.</i>	(DELPHI Collab.)

ABE	96B	PR D53 3496	F. Abe <i>et al.</i>	(CDF Collab.)
ABE	96L	PRL 76 4675	F. Abe <i>et al.</i>	(CDF Collab.)
ABE	96N	PRL 77 1945	F. Abe <i>et al.</i>	(CDF Collab.)
ABE	96Q	PR D54 6596	F. Abe <i>et al.</i>	(CDF Collab.)
ABREU	96F	ZPHY C71 11	P. Abreu <i>et al.</i>	(DELPHI Collab.)
ADAM	96D	ZPHY C72 207	W. Adam <i>et al.</i>	(DELPHI Collab.)
BUSKULIC	96E	ZPHY C69 585	D. Buskulic <i>et al.</i>	(ALEPH Collab.)
BUSKULIC	96M	PL B377 205	D. Buskulic <i>et al.</i>	(ALEPH Collab.)
BUSKULIC	96V	PL B384 471	D. Buskulic <i>et al.</i>	(ALEPH Collab.)
PDG	96	PR D54 1	R. M. Barnett <i>et al.</i>	
ABE	95R	PRL 74 4988	F. Abe <i>et al.</i>	(CDF Collab.)
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ACCIARRI	95H	PL B363 127	M. Acciari <i>et al.</i>	(L3 Collab.)
ACCIARRI	95I	PL B363 137	M. Acciari <i>et al.</i>	(L3 Collab.)
AKERS	95G	PL B350 273	R. Akers <i>et al.</i>	(OPAL Collab.)
AKERS	95J	ZPHY C66 555	R. Akers <i>et al.</i>	(OPAL Collab.)
BUSKULIC	95J	PL B356 409	D. Buskulic <i>et al.</i>	(ALEPH Collab.)
BUSKULIC	95O	PL B361 221	D. Buskulic <i>et al.</i>	(ALEPH Collab.)
ABREU	94D	PL B324 500	P. Abreu <i>et al.</i>	(DELPHI Collab.)
ABREU	94E	ZPHY C61 407	P. Abreu <i>et al.</i>	(DELPHI Collab.)
Also		PL B289 199	P. Abreu <i>et al.</i>	(DELPHI Collab.)
AKERS	94J	PL B337 196	R. Akers <i>et al.</i>	(OPAL Collab.)
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BUSKULIC	94B	PL B322 441	D. Buskulic <i>et al.</i>	(ALEPH Collab.)
BUSKULIC	94C	PL B322 275	D. Buskulic <i>et al.</i>	(ALEPH Collab.)
PDG	94	PR D50 1173	L. Montanet <i>et al.</i>	(CERN, LBL, BOST+)
ABE	93F	PRL 71 1685	F. Abe <i>et al.</i>	(CDF Collab.)
ACTON	93H	PL B312 501	P.D. Acton <i>et al.</i>	(OPAL Collab.)
BUSKULIC	93G	PL B311 425	D. Buskulic <i>et al.</i>	(ALEPH Collab.)
ABREU	92M	PL B289 199	P. Abreu <i>et al.</i>	(DELPHI Collab.)
ACTON	92N	PL B295 357	P.D. Acton <i>et al.</i>	(OPAL Collab.)
BUSKULIC	92E	PL B294 145	D. Buskulic <i>et al.</i>	(ALEPH Collab.)
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